

AA746

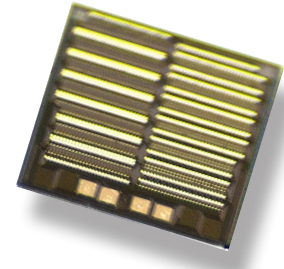
MagnetoResistive FreePitch Sensor

The AA746 is an angular sensor based on the Anisotropic MagnetoResistive (AMR) effect. The sensor contains two Wheatstone bridges with common ground (GND) and supply pin (V_{CC}). They are shifted at a relative angle of 45° to one another.

A rotating magnetic field in the sensor plane delivers two sinusoidal output signals with the double frequency of the angle α between sensor and magnetic field direction shown in Fig. 1. The function of these signals is $\sin(2\alpha)$ and $\cos(2\alpha)$.

The AA746 is optimized for a low magnetic field strength down to 5 kA/m.

The bond version of AA746 is available as bare die on wafer or wafer pack. For SMD processing, the sensor is available in a LGA-package.



Product Overview

Article description	Package	Delivery Type
AA746ACA-AB	Die on wafer ¹⁾	Waferbox
AA746ACA-AC	Bare die	Waffle pack (324)
AA746AMA-AE	LGA6L	Tape and Reel (2500)

¹⁾ Minimum order quantities apply.

Quick Reference Guide

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{CC}	Supply voltage	-	5.0	-	V
V_{off}	Offset voltage per V_{CC}	-0.5	-	+0.5	mV/V
V_{peak}	Signal amplitude per V_{CC}	12.0	13.0	14.0	mV/V
R_s	Sensor resistance	0.45	0.60	0.75	k Ω

Absolute Maximum Ratings

In accordance with the absolute maximum rating system (IEC60134).

Symbol	Parameter	Min.	Max.	Unit
V_{CC}	Supply voltage	-9.0	+9.0	V
T_{amb}	Ambient temperature	-40	+125	$^\circ\text{C}$

Stresses beyond those listed under "Absolute maximum ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Features

- Based on the Anisotropic MagnetoResistive (AMR) effect
- Contains two Wheatstone bridges
- Sine and cosine output
- Temperature range from -40°C to $+125^\circ\text{C}$

Advantages

- Non-contacting angle measurement
- Large air gap
- Excellent accuracy
- Position tolerant
- Minimal offset voltage
- Negligible hysteresis

Applications

- Incremental or absolute position measurement (linear and rotary motion)
- Motor commutation
- Rotational speed measurement
- Angle measurement (180° absolute on shaft end)



ESD

Magnetic Data

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
H_{ext}	Magnetic field strength ¹⁾		5.0	-	-	kA/m

¹⁾ The stimulating magnetic field in the sensor plane necessary to ensure the minimum error as specified in note 7.

Electrical Data

$T_{amb} = 25\text{ °C}$; $H_{ext} = 25\text{ kA/m}$; $V_{CC} = 5\text{ V}$; unless otherwise specified.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{CC}	Supply voltage		-	5.0	-	V
V_{off}	Offset voltage per V_{CC}	See Fig. 1	-0.5	-	+0.5	mV/V
TC_{Voff}	Temperature coefficient of V_{off} ²⁾	$T_{amb} = (-40...+125)\text{ °C}$	-2.0	-	+2.0	($\mu\text{V/V}$)/K
V_{peak}	Signal amplitude per V_{CC} ³⁾	See Fig. 1	12.0	13.0	14.0	mV/V
TC_{Vpeak}	Temperature coefficient of V_{peak} ⁴⁾	$T_{amb} = (-40...+125)\text{ °C}$	-0.36	-0.42	-0.48	%/K
R_S	Sensor resistance ⁵⁾		0.45	0.60	0.75	k Ω
R_B	Bridge resistance ⁶⁾		0.9	1.2	1.5	k Ω
TC_{RB}	Temperature coefficient of R_B ⁷⁾	$T_{amb} = (-40...+125)\text{ °C}$	0.24	0.28	0.32	%/K

$$^2) TC_{Voff} = \frac{V_{off(T2)} - V_{off(T1)}}{T_2 - T_1} \text{ with } T_1 = +25\text{ °C}; T_2 = +125\text{ °C}.$$

³⁾ Maximal output voltage without offset influences. Periodicity of V_{peak} is $\sin(2\alpha)$ and $\cos(2\alpha)$.

$$^4) TC_{Vpeak} = 100 \cdot \frac{V_{peak(T2)} - V_{peak(T1)}}{V_{peak(T1)} \cdot (T_2 - T_1)} \text{ with } T_1 = +25\text{ °C}; T_2 = +125\text{ °C}.$$

⁵⁾ Sensor resistance between pads 1 and 2 (bare die); pads 3 and 4 (LGA6L).

⁶⁾ Bridge resistance between pads 3 and 4, 5 and 6 (bare die); pads 1 and 5, 2 and 6 (LGA6L).

$$^7) TC_{RB} = 100 \cdot \frac{R_{B(T2)} - R_{B(T1)}}{R_{B(T1)} \cdot (T_2 - T_1)} \text{ with } T_1 = +25\text{ °C}; T_2 = +125\text{ °C}.$$

Accuracy

$T_{amb} = 25\text{ °C}$; $H_{ext} = 5\text{ kA/m}$; $V_{CC} = 5\text{ V}$; unless otherwise specified.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$\Delta\alpha$	Angular error ⁸⁾		-	± 0.25	± 0.5	deg
k	Amplitude synchronism ⁹⁾		-0.5	0	+0.5	% of V_{peak}

⁸⁾ $\Delta\alpha = |\alpha_{real} - \alpha_{measured}|$ without offset influences due to deviations from ideal sinusoidal characteristics.

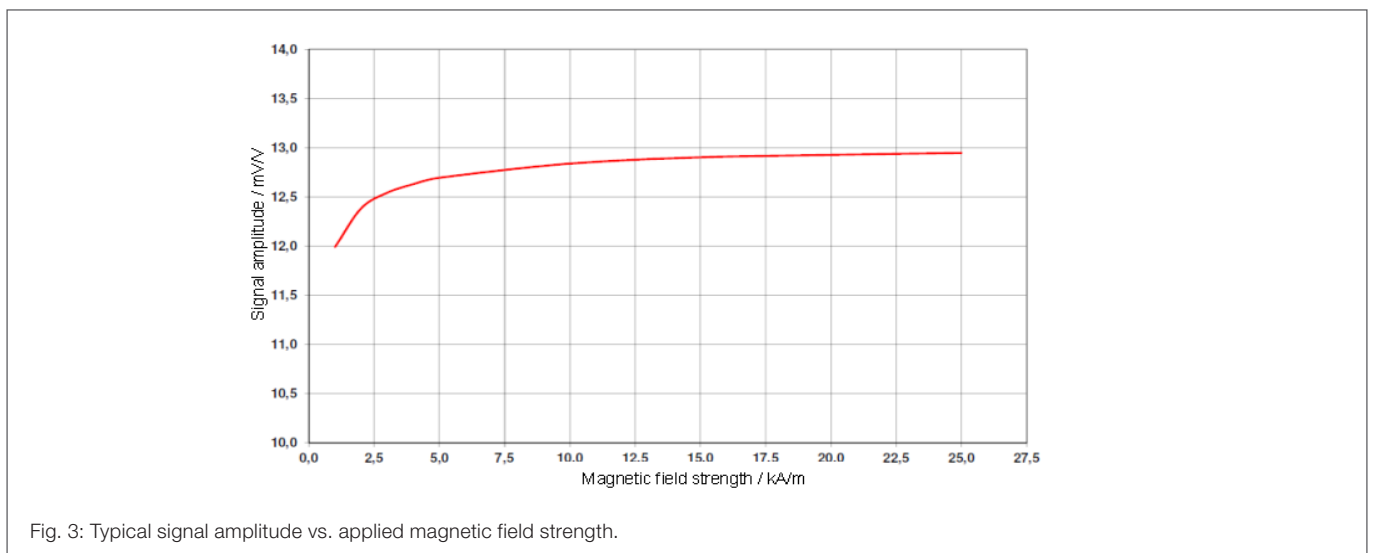
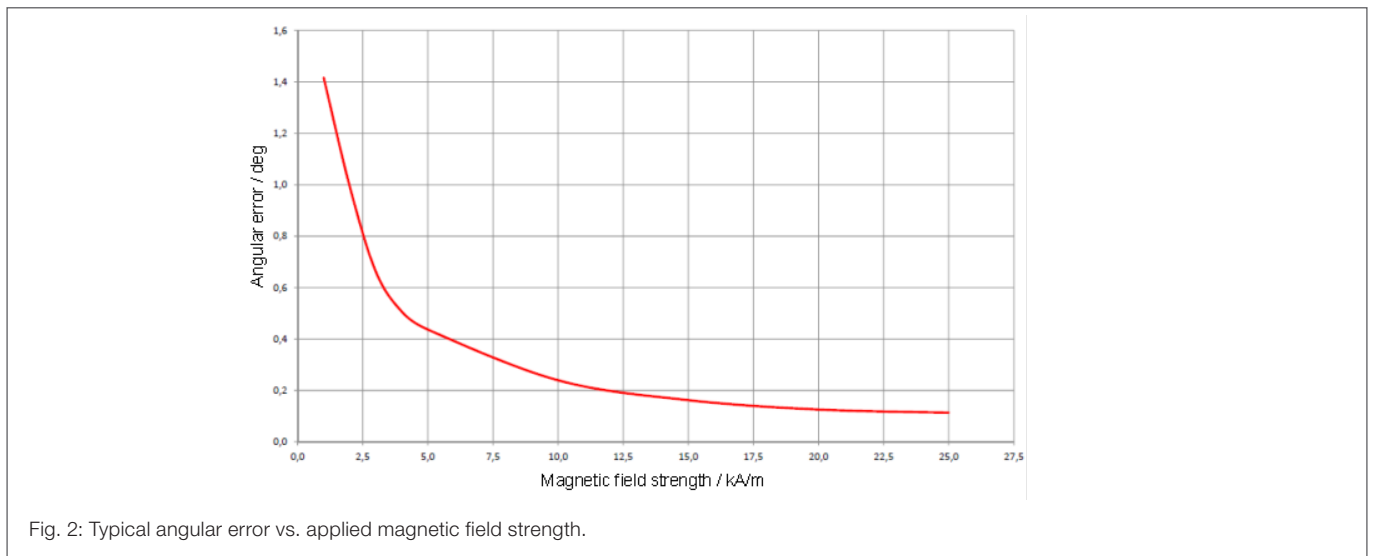
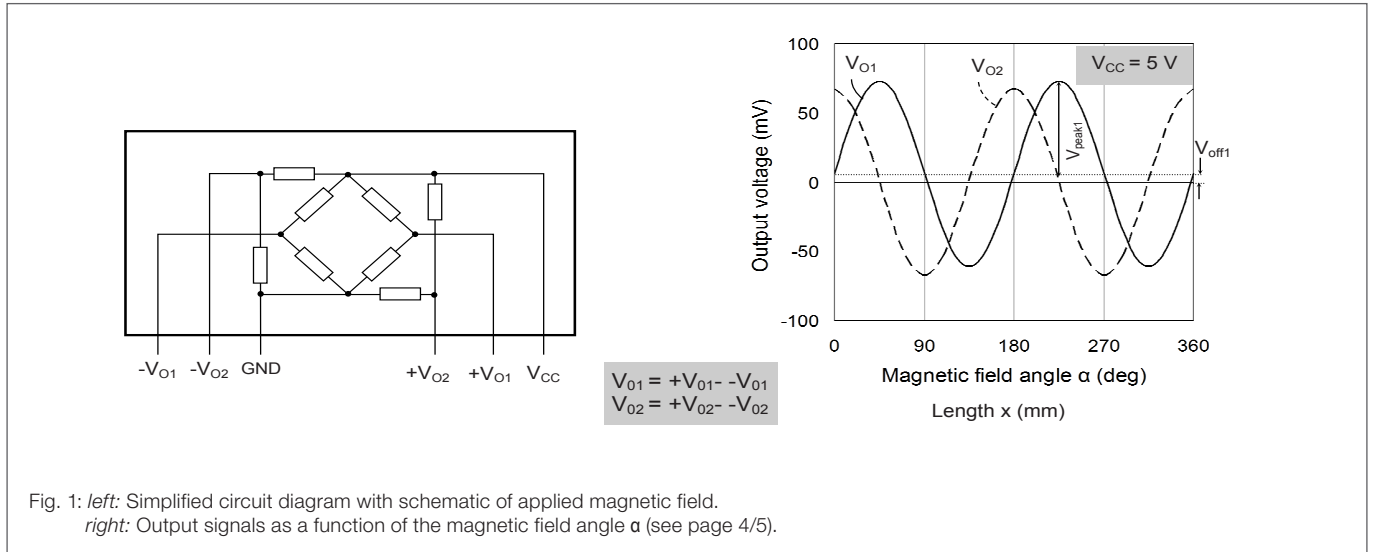
$$^9) k = 100 - 100 \cdot \frac{V_{peak1}}{V_{peak2}}.$$

Dynamic Data

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
ω	Angular velocity of the magnetic field ¹⁰⁾		1	-	-	MHz

¹⁰⁾ No significant amplitude attenuation.

General Data



AA746ACA as Bare Die

Pinning

Pin	Symbol	Parameter
1	V_{CC}	Supply voltage
2	GND	Ground
3	$+V_{O2}$	Positive output voltage bridge 2
4	$-V_{O2}$	Negative output voltage bridge 2
5	$+V_{O1}$	Positive output voltage bridge 1
6	$-V_{O1}$	Negative output voltage bridge 1

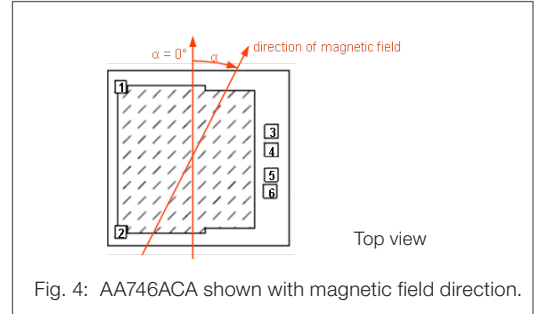


Fig. 4: AA746ACA shown with magnetic field direction.

Dimensions

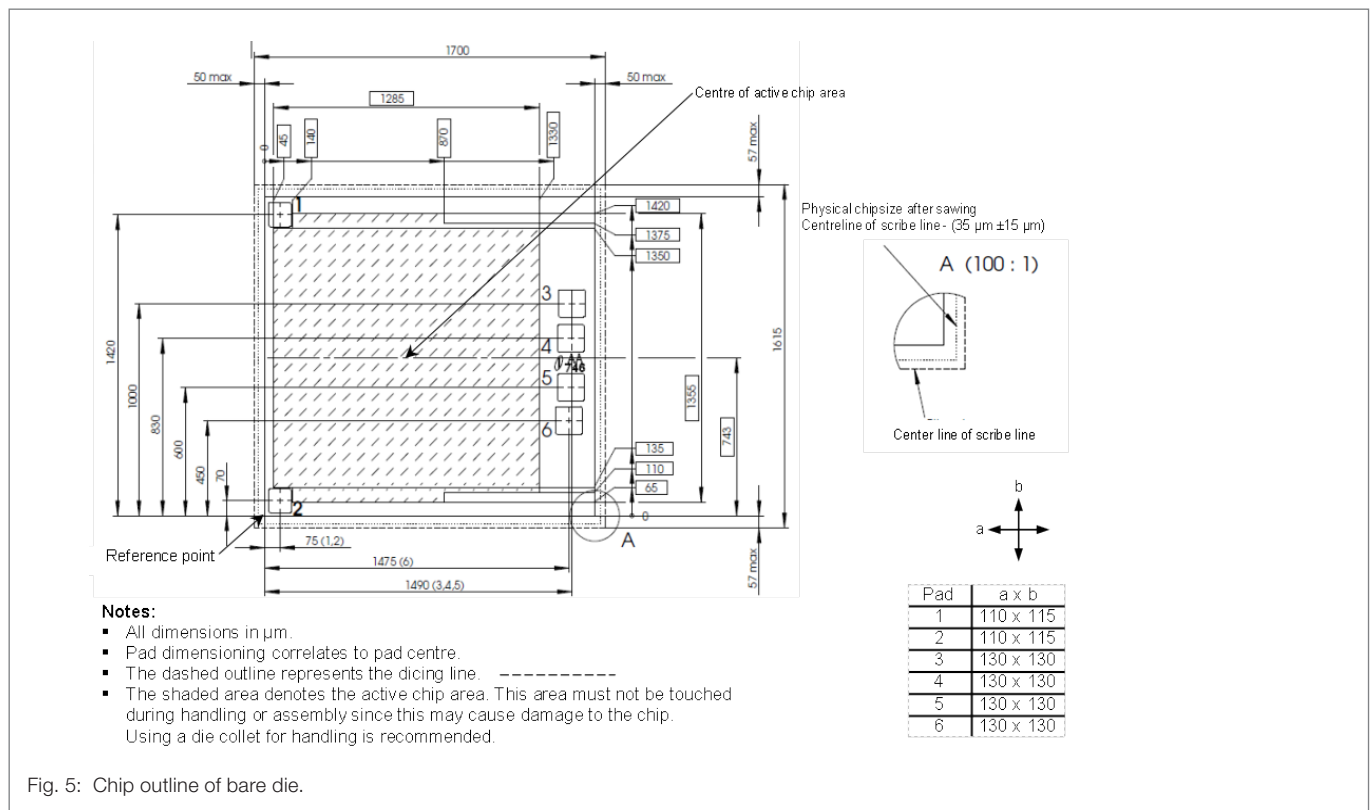


Fig. 5: Chip outline of bare die.

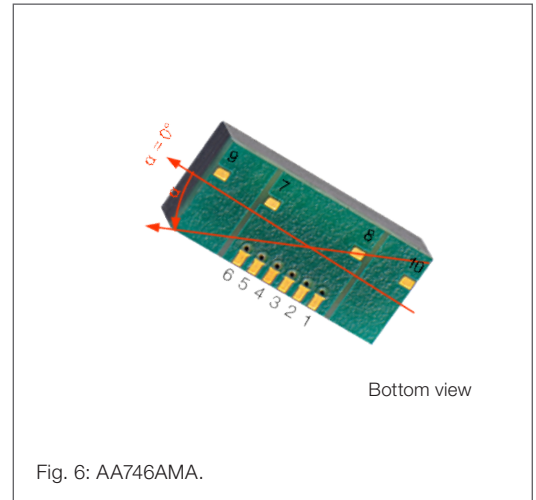
Data for Packaging and Interconnection Technologies

Parameter	Value	Unit
Chip area	1.7 x 1.6	mm
Chip thickness	525 ± 10	μm
Pad diameter (all)	See Fig. 5	μm
Pad thickness	0.8	μm
Pad material	AlCu	-

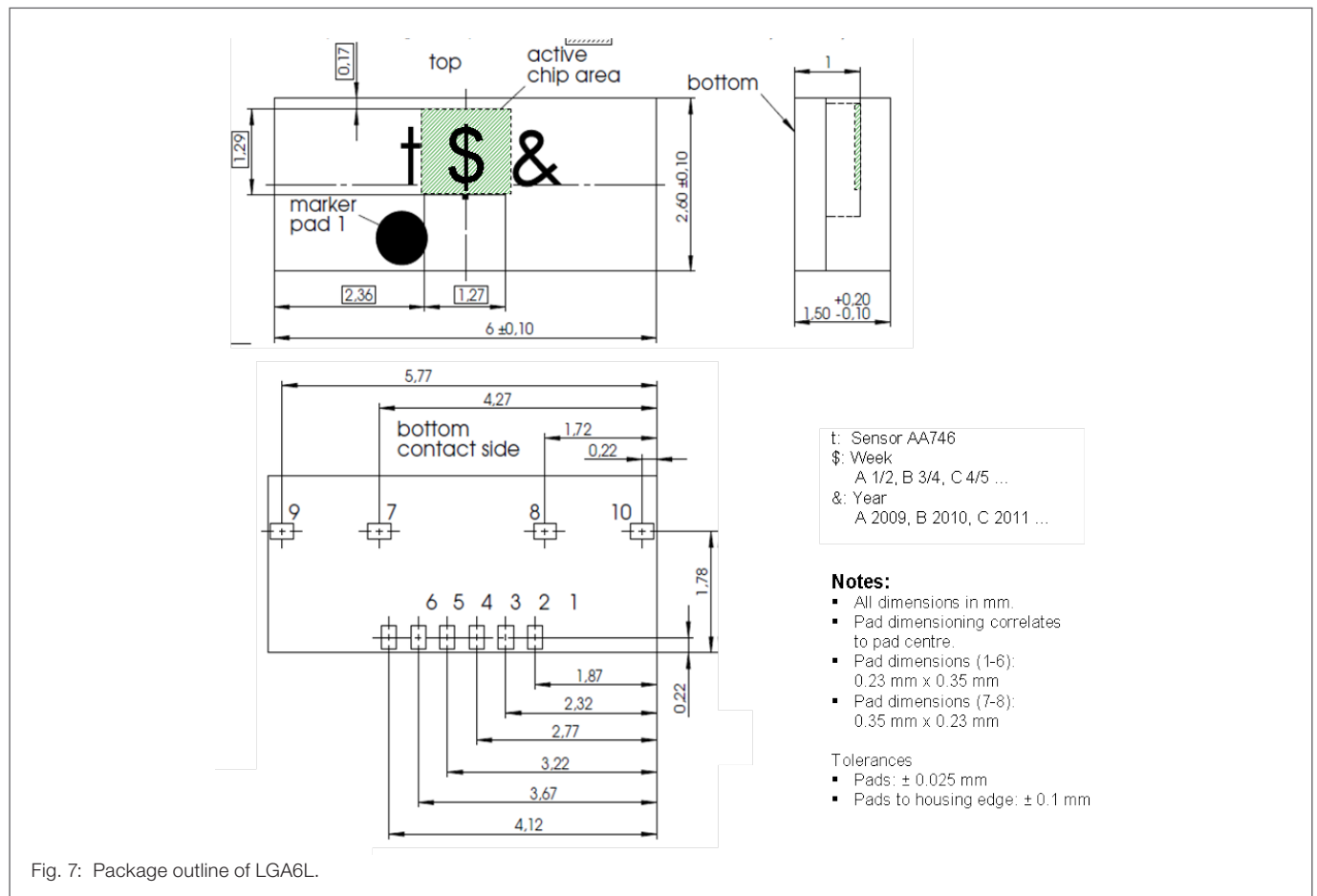
AA746AMA in LGA6L Housing

Pinning

Pin	Symbol	Parameter
1	+V _{O1}	Positive output voltage bridge 1
2	+V _{O2}	Positive output voltage bridge 2
3	GND	Ground
4	V _{CC}	Supply voltage
5	-V _{O1}	Negative output voltage bridge 1
6	-V _{O2}	Negative output voltage bridge 2
7	n.c.	Not connected
8	n.c.	Not connected
9	n.c.	Not connected
10	n.c.	Not connected



Dimensions



General Information

Product Status

Article	Status
AA746ACA-AB	The product is in series production.
AA746ACA-AC	The product is in series production.
AA746AMA-AE	The product is in series production.
Note	The status of the product may have changed since this data sheet was published. The latest information is available on the internet at www.sensitec.com .

Disclaimer

Sensitec GmbH reserves the right to make changes, without notice, in the products, including software, described or contained herein in order to improve design and/or performance. Information in this document is believed to be accurate and reliable. However, Sensitec GmbH does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information. Sensitec GmbH takes no responsibility for the content in this document if provided by an information source outside of Sensitec products.

In no event shall Sensitec GmbH be liable for any indirect, incidental, punitive, special or consequential damages (including but not limited to lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework charges) irrespective the legal base the claims are based on, including but not limited to tort (including negligence), warranty, breach of contract, equity or any other legal theory.

Notwithstanding any damages that customer might incur for any reason whatsoever, Sensitec product aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the General Terms and Conditions of Sale of Sensitec GmbH. Nothing in this document may be interpreted or construed as an offer to sell products that is open for acceptance or the grant, conveyance or implication of any license under any copyrights, patents or other industrial or intellectual property rights.

Unless otherwise agreed upon in an individual agreement Sensitec products sold are subject to the General Terms and Conditions of Sales as published at www.sensitec.com.

General Information

Application Information

Applications that are described herein for any of these products are for illustrative purposes only. Sensitec GmbH makes no representation or warranty – whether expressed or implied – that such applications will be suitable for the specified use without further testing or modification.

Customers are responsible for the design and operation of their applications and products using Sensitec products, and Sensitec GmbH accepts no liability for any assistance with applications or customer product design. It is customer's sole responsibility to determine whether the Sensitec product is suitable and fit for the customer's applications and products planned, as well as for the planned application and use of customer's third party customer(s). Customers should provide appropriate design and operating safeguards to minimize the risks associated with their applications and products.

Sensitec GmbH does not accept any liability related to any default, damage, costs or problem which is based on any weakness or default in the customer's applications or products, or the application or use by customer's third party customer(s). Customer is responsible for doing all necessary testing for the customer's applications and products using Sensitec products in order to avoid a default of the applications and the products or of the application or use by customer's third party customer(s).

Sensitec does not accept any liability in this respect.

Life Critical Applications

These products are not qualified for use in life support appliances, aeronautical applications or devices or systems where malfunction of these products can reasonably be expected to result in personal injury.

Copyright © 2017 by Sensitec GmbH, Germany

All rights reserved. No part of this document may be copied or reproduced in any form or by any means without the prior written agreement of the copyright owner. The information in this document is subject to change without notice. Please observe that typical values cannot be guaranteed. Sensitec GmbH does not assume any liability for any consequence of its use.

Sensitec GmbH

Georg-Ohm-Str. 11 · 35633 Lahnau · Germany
Tel. +49 6441 9788-0 · Fax +49 6441 9788-17
www.sensitec.com · sensitec@sensitec.com

